INVESTIGATION REPORT
ON THE
AGENT RELEASE FROM THE
COMMON INCINERATOR STACK
ON MAY 8 AND 9, 2000
AT THE
TOOELE CHEMICAL AGENT DEMILITARIZATION FACILITY

UTAH DEPARTMENT OF ENVIROMENTAL QUALITY
DIVISION OF SOLID AND HAZARDOUS WASTE

INTRODUCTION

This report documents the investigation performed by the Utah Division of Solid and Hazardous Waste (DSHW) into the release of nerve agent from the Common Incinerator Stack (Stack) at the Tooele Chemical Agent Demilitarization Facility (TOCDF). Attached to this report and referenced in the report are documents created by DSHW staff and documents and reports collected by DSHW staff during the investigation.

At 11:26 PM on the night of May 8, 2000, the Automatic Continuous Air Monitoring System (ACAMS) which monitors the TOCDF Stack went into alarm indicating the potential presence of agent. This was followed 12 minutes later by an alarm on the ACAMS that monitors the duct between the Deactivation Furnace System (DFS) and the Stack. The alarm condition lasted for approximately 45 minutes and then cleared, indicating that the cause of the alarm was no longer present. At 12:28 AM on May 9, 2000, the ACAMS in the Stack and DFS duct alarmed again. This alarm condition lasted for approximately 30 minutes. Tubes were pulled from the Depot Area Air Monitoring System (DAAMS), another type of monitor used to confirm or deny the validity of the ACAMS alarm. Analysis of these tubes confirmed that a small amount of the chemical warfare agent GB, also known as Sarin, was released from the Stack.

INVESTIGATION

On the morning of May 9, 2000 at about 3:00 AM, Martin Gray, Manager of the Chemical Demilitarization Section of the DSHW received a phone message from Jackie Hansen of EG&G stating that an agent release had occurred at the TOCDF. At about 7:00 AM that same morning, a phone call from Roger Rassmussen of Deseret Chemical Depot (DCD) confirmed the release and reported that the highest concentration detected by the ACAMS was about eight times the Time Weighted Average (TWA). A TWA of one is the amount of agent that a worker can be exposed to for eight hours a day for a lifetime. A review of data from the remote monitoring system used by the DSHW seemed to confirm this message. The agent alarm level for ACAMS PAS 702, which is located in the duct, however; was mis-read from the DSHW remote monitor and was initially reported via e-mail to DSHW management to be 8.7 times the Allowable Stack Concentration (ASC). At 8:00 AM on May 9, 2000, a conference call was set up between the DSHW and TOCDF. During the call, TOCDF confirmed that an agent release had occurred. TOCDF reported that the highest reading in the Stack was 3.63 ASC. TOCDF personnel stated that the tubes from the appropriate DAAMS stations had been analyzed during the early morning hours and confirmed the presence of agent in the DFS duct and the Stack. The DSHW was informed that there had been some problems in operating the DFS and that while employees were cleaning the feed chute to the incinerator, pressures in the system began to fluctuate. Following this conversation, the DSHW began this investigation.

Documents Collected and Reviewed

The following information was requested by DSHW investigators to support this investigation and is included in this report as attachments.

All data associated with the ACAMS and DAAMS monitoring, alarms and analysis (Attachment 2)
Meteorological data for the time of the event (Attachment 3)
Operating data for the DFS (Attachment 4)
DFS Alarm list (Attachment 5)
Perimeter DAAMS analysis data (Attachment 6)
ACAMS reports for the DFS room as well as both Explosive Containment Rooms (ECR) (Attachment 7)
Copies of Control Room Operators Log Books (Attachment 8)
Plume Modeling and other reports from Deseret Chemical Depot Emergency Operations Center (DCD EOC) (Attachment 9)
Chronological List of Events compiled by operations personnel (Attachment 10)
Calculations of the amount of agent released (Attachment 11)

Memorandum of Understanding between DCD and Tooele County; Chemical Stockpile Emergency Preparedness Program (CSEPP) Appendices to the State Emergency Operations Plan, Section 2 and Section 5 (Attachment 12)
Official Written Notification from TOCDF to DSHW about the Release (Attachment 13)
Letter From Centers for Disease Control on Preliminary Findings (Attachment 14)
Agent Monitoring Plan Pages (Attachment 15)
TOCDF Contingency Procedure Agent Detected in the Stack, Revision 2 (Attachment 16)
Map of DCD showing meterologic stations and perimeter monitoring stations, Wind data (Attachment 17)

DSHW personnel compiled a timeline of the events that is included as Attachment 1.

Events

At approximately 4:20 PM on the afternoon of May 8, 2000, the TOCDF had a jam in the lower feed gate of the DFS feed chute from Explosives Containment Room (ECR) B. The TOCDF had been processing M56 rockets at normal rates. The last rocket fed prior to the jam was at approximately 3:50 PM. Operators began preparations for an entry to clear the jam. DFS operators began to control the temperature in the feed chute by opening the chute water sprays to about 40%. By 5:30 PM, all waste had cleared the DFS kiln and the Heated Discharge Conveyor (HDC).

At approximately 8:10 PM, the pressure in the DFS kiln was lowered to -1.5 inches water column (in. w.c.) in accordance with the Plan for Non-Normal Operating Conditions, Plan No. DFS-011-01 (see Attachment 10). This reduction in the pressure in the kiln also began to lower the residence time in the DFS Afterburner. Residence time is the amount of time that gases in the Afterburner are exposed to heat. At approximately 8:20 PM, a DFS Afterburner Exhaust Flow High Flow alarm occurred, indicating high air flow through the DFS incinerator and pollution abatement system. This high air flow condition remained virtually constant until approximately 10:00 PM (see Attachment 5).

At approximately 8:30 PM, personnel at TOCDF began to inspect the feed chute for the cause of the jam. Maintenance personnel determined that there was a small amount of debris in the chute, about enough to fill a coffee can. The decision was made to wash down the chute.

At approximately 8:42 PM, the DFS Furnace Operator noticed that the pressure in the kiln was beginning to make minor fluctuations which were affecting the operation of the DFS Induced Draft (ID) fans. These fans pull air through the DFS incinerator and pollution abatement system. By approximately 8:48 PM, it was noticed that the pressure controlling instrument had not been able to stabilize the pressure in the kiln. The fluctuating pressure was causing the ID fan inlet damper to fluctuate between 30% and 90% open. The DFS Furnace Operator took manual control of the pressure controlling instrument and began attempting to stabilize the kiln pressure.

Between 8:37 PM and 9:30 PM, the DFS upper feed gate was opened and closed several times while maintenance personnel were attempting to wash down the chute. The opening and closing of the gate was caused by personnel having to leave the room multiple times in order to obtain parts for the water lance used to wash down the chute.

The wash down of the chutes was complete by approximately 9:30 PM and both feed gates for the chute were closed. The maintenance personnel then changed out the agent strainers in ECR B and placed approximately one pound of agent contaminated waste on the upper feed gate. This waste was never fed to the incinerator and was removed from the feed gate at approximately 4:54 AM on May 9,

2000 (see Attachment 8).

At approximately 9:45 PM, the DFS Furnace Operator noted that the DFS PAS Venturi was 100% open. At this time, the operator continued to have a difficult time stabilizing the DFS. At approximately 9:59 PM, the DFS exhaust flow meter sent a malfunction signal to the control room. This was followed by a Flow Lo Lo alarm from the same meter (24-FIT-430) which automatically shut down both burners on the DFS Afterburner and the burner in the DFS kiln and locked them out. The DFS Afterburner temperature, which had been dropping from 2120 °F since approximately 9:58 PM, dropped below the Part B Permit low limit of 2050°F at the time the burners were shut down. At approximately 10:06 PM, the DFS kiln temperature dropped below the Part B Permit low limit of 950 °F. At approximately this same time, the DFS Afterburner pressure dropped to -6.0 in. w.c., the bottom of the range for this instrument, and remained there until approximately 10:30 PM when it begin to fluctuate.

At approximately 10:10 PM, the DFS Furnace Operator determined that there was a problem with the Kurz flow meter (24-FIT-430) that was causing the lock-out of the burners on the DFS. At approximately the same time, the liquid level in the DFS PAS Demister began to rise.

At approximately 10:26 PM, DFS Furnace Operators began attempts to purge the afterburner in order to re-light the burners. They felt that re-lighting the DFS Afterburner would be the safest configuration for preventing a release of agent. I&C Technicians were troubleshooting the Kurz flow meter at this time. The technicians determined that the meter had been saturated with liquid and would need to dry out. The Control Room Supervisor began the process to get a temporary change in place to by-pass the lock-out of the burners to allow the purging and re-lighting of the DFS Afterburner. The process of getting the temporary change approved took approximately 35 minutes. By the time the approval was granted the first Stack agent alarm had occurred.

During the approximately 90-minute period between the lock-out of the DFS burners and the ACAMS alarms, the residence time in the DFS Afterburner dropped to a low of 1.7 seconds. This residence time is approximately half of the normal residence time. The differential pressure across the DFS PAS Venturi jumped to 50 in. w.c., which is the top of the range for this instrument.

At approximately 10:48 PM, the DFS Kiln pressure reached -2.0 in. w.c. This is the bottom of the range on this instrument. The pressure remained at this level until approximately 11:34 PM. At approximately this same time the DFS Afterburner pressure again dropped to -6.0 in. w.c. where it remained until approximately 11:42 PM.

At approximately 11: 18 PM, operators shut down the DFS PAS clean liquor pump. This was done to stop the amount of fluid collecting in the DFS PAS Demister that had reached a Hi Hi level at approximately 11:13 PM.

At approximately 11:26 PM, the first Stack ACAMS alarm occurred on ACAMS PAS 701C. The alarm level was 0.67 ASC. At this time, the site was masked. The temperature in the DFS Kiln was approximately 204 °F and the temperature in the DFS Afterburner was approximately 1250 °F. The pressure in the DFS Room at this time was approximately -2.0 in. w.c., the pressure in ECR A was approximately -1.38 in. w.c., and the pressure in ECR B was approximately -2.15 in. w.c.

Stack ACAMS PAS 701A alarmed at approximately 11:27 PM at a level of 1.57 ASC and was followed by ACAMS PAS 702 that alarmed at approximately 11:41 PM at a level of 1.45 ASC. The

temperatures in the DFS Kiln and Afterburner were continuing to drop.

At approximately 11:34 PM, the DFS Kiln pressure began to fluctuate and eventually rose to 0.23 in. w.c. within two minutes. The DFS Afterburner residence time also rose to approximately 2.7 seconds.

At approximately 11:38 PM, monitoring operators started DAAMS tube PAS 701 E and removed the DAAMS tubes PAS 701 D for analysis. At approximately 11:40 PM, both Stack ACAMS reached their highest readings, 70lA at 3.41 ASC and 701C at 3.63 ASC. At this time, the DFS Kiln pressure again dropped to-2.0 in. w.c., the bottom of the range for this instrument. The pressure in the DFS Room at this time was approximately -1.21 in. w.c., pressure in ECR A was approximately -1.32 in. w.c., and pressure in ECR B was approximately -2.05 in. w.c.

At approximately 11:44 PM, the DFS Operator was instructed to "bottle up" the furnace. This term means to close dampers and slow down air flow in order to slow the loss of temperature in the DFS. Once this process began, residence time in the DFS Afterburner climbed to a high of 10 seconds, the differential pressure drop across the DFS PAS Venturi dropped to 1.0 in. w.c. and the DFS Kiln pressure went slightly positive in the range of 0.2 in. w.c. to 0.6 in. w.c. The DFS Afterburner temperature began to rise at this time.

At approximately 12:18 AM, the ACAMS alarms had cleared on the Stack and duct and the notice to unmask the site was given.

At approximately 12:23 AM, the DFS Operator was directed to again attempt to light the burners in the DFS Afterburner. This necessitated removing the DFS from the "bottled up" condition. The DFS Kiln pressure once again went to a negative pressure and began to fluctuate. The DFS PAS Venturi differential pressure jumped to 50 in. w.c. and the DFS Afterburner residence time began to drop from 10 seconds. The DFS Kiln temperature had risen to 227 °F and the DFS Afterburner temperature had risen to 1597 °F. A lock-out of the burners occurred again because the DFS PAS clean liquor pump was not running.

At approximately 12:28 AM, the DFS duct ACAMS PAS 702 alarmed. This was quickly followed by the Stack ACAMS PAS 701 B alarm. The site was masked again.

At approximately 12:32 AM, the DFS Operator was again directed to "bottle up" the DFS.

At approximately 1:07 AM, the site was unmasked.

At approximately 6:55 AM, some of the DAAMS tubes from the facility perimeter monitoring stations were pulled and analyzed. The wind at the time of the agent release was blowing towards the north at about five miles per hour. Stations 906, 907 and 908 were in the direction of the wind. The tubes from these stations showed no agent detection, however, station 905 did detect something on the "A" tube (see Attachment 6). The detection level was below the Limit of Quantification for the 12 hour monitoring time and personnel performing the tube analysis followed their Standard Operating Procedures and did not analyze the "B" tube. Data collected by DSHW investigators showed that this station has had similar readings prior to the release (see Attachment 6). Additionally, this station is at 90 degrees to the wind direction. Based on the wind direction and no detection in downwind monitoring stations, it is believed that the material detected at station 905 was not chemical agent from the Stack release.

Notifications

Documentation shows that the TOCDF Control Room notified the DCD EOC at approximately 11:30 PM on May 8, 2000, following the first ACAMS alarm in the Stack (see Attachment 9). According to a Memorandum of Understanding between DCD and Tooele County, DCD EOC personnel will notify Tooele County Emergency Responders at the earliest possible opportunity even if the event is only suspected (see Attachment 12). On this night, DCD EOC personnel chose not to make this call. At approximately 11:42 PM, the TOCDF Control Room updated the DCD EOC with the highest readings in the Stack as well as informing them that the DFS Duct ACAMS had also alarmed. At approximately 12:25 AM on May 9, 2000, the TOCDF Control Room informed DCD EOC that all the ACAMS had cleared and that the DAAMS tube analysis was pending.

At approximately 12:32 AM on May 9, 2000, the DCD EOC was informed that the Stack ACAMS were back in alarm.

At approximately 1:17 AM, the DCD EOC received notification from TOCDF that the DAAMS tube analysis from the first set of alarms was completed and that the presence of agent was confirmed.

At approximately 3:34 AM, the DCD EOC contacted the Tooele County dispatcher and notified them that there had been a confirmed ACAMS alarm in the TOCDF Stack. This phone call was followed by a fax of the Chemical Notification Form. This dispatcher was informed that the event had been classified as a Limited Area Event. The normal procedure for the Tooele County dispatcher would be to page personnel from the county Emergency Management office. The Tooele County dispatcher made a decision not to page Tooele County Emergency Management personnel.

At approximately 3:00 AM, notification was made to the office of Martin Gray at the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste.

On the morning of May 9, 2000, Tooele County Emergency Management personnel discovered the Chemical Notification Form and contacted the State of Utah, Division of Comprehensive Emergency Management and informed them of the event.

Personnel at the Chemical Agent Munitions Disposal System (CAMDS) were not notified of the event. DCD personnel stated that during a Limited Area Event they likely would only contact personnel who were downwind of the event. During this event, CAMDS was cross wind and modeling showed that no agent could reach CAMDS. At 3:55 AM on May 9, 2000, TOCDF contacted CAMDS and requested that they collect the DAAMS tubes from the perimeter monitoring stations that were downwind during the release.

CONCLUSIONS

The events that led up to the release of agent from the TOCDF Stack began with the DFS Feed Chute jam and the activities centered around removing this jam. As noted in control room logs, see Attachment 8, it appears that a larger than normal amount of water was used to remove jammed material from the chute. Additionally, due to delays in making the entry to clean out the jam, the cooling water sprays in the DFS feed chute were 40% open for some time prior to the chute cleaning operation. As this water enters the DFS Kiln it flashes off as steam which creates pressure fluctuations within the kiln. The DFS Operator at the time was unable to bring the DFS back into a steady state condition.

Because no waste had been fed to the DFS since much earlier in the evening the Control Room Supervisor saw this as an opportunity for this operator to gain some additional experience and decided to allow the operator to continue attempting to control the DFS. The Control Room Supervisor was unaware of the ECR maintenance waste that had been placed on the upper feed gate.

As time progressed, the DFS Operator was unable to stabilize the DFS. The high flow of air through the system lowered the residence time well below the normal residence time for destruction of agent. The high flow also pulled liquid from the DFS PAS Scrubber sump through the duct into the Demister. This transfer of liquid is not normal and is what saturated the Kurz flow meter causing the shutdown of the DFS burners and burner lock-out.

As shown by operations data (see Attachments 4 and 10), the pressure in the DFS went more negative than normal, at least -6.0 in. w.c. This pressure is four times more negative than any of the areas surrounding the DFS kiln causing the DFS to pull air from the surrounding rooms, ECR A, ECR B, and the DFS Room.

Monitoring data shows that the DFS room had no agent readings and ECR A had agent readings of approximately one TWA at the time of the event (see Attachments 7 and 10). In contrast, ECR B, where rocket operations take place, had agent readings above 200,000 TWA (value converted from 0.2 MPL). It should be noted that the agent readings in ECR B are typically higher when compared to areas of the facility where munitions are not punched and drained of agent. For ECR B, these levels were within normal operating ranges. The readings in ECR B ranged from 0.19 to 0.32 times the Maximum Permissible Limit (MPL). At 1.0 times the MPL, entrants wearing Demilitarization Protective Ensemble (DPE) must exit the area because the suit has not been tested at higher levels. These values may seem low, unless converted to a more commonly used value such as Immediately Dangerous to Life or Health (IDLH).

Although no agent-contaminated waste was in the incinerator, a small amount of agent contaminated waste was on the upper feed gate in ECR B. This small amount of waste contributed to the agent readings in ECR B. Air was being pulled from ECR B through the DFS system because the DFS was much more negative than the ECRs. The temperatures in the kiln and afterburner were reduced below the limits set in the TOCDF Part B Permit for the destruction of chemical agent. Additionally, the residence time in the afterburner was below that needed for the destruction of chemical agent. These facts, coupled with the agent levels in ECR B, led to the release of chemical agent from the Stack at TOCDF.

When the ACAMS alarmed the first time at approximately 11:26 PM, the Stack ACAMS alarmed before the ACAMS monitoring the duct. This initially caused some confusion among operators because normally the duct instrument should alarm first since it is closer to the incinerator. Monitoring personnel stated that when an incinerator loses its flame, more condensate is present in the Stack and ducts than normal. Monitoring personnel theorize that this large amount of moisture enters the column in the ACAMS and attenuates the readings of the instrument. This could account for the delay in the alarm as well as the alarm level peaking at a lesser amount than the Stack instruments. The DAAMS tube for the DFS duct confirmed at a level of 4.01 times the ASC.

A review of *Contingency Procedure Agent Detected in the Stack, EG 040.A01, Revision 2* and discussions with TOCDF personnel revealed that the procedure for agent detected in the stack was not followed correctly. Operators appear to have followed the procedures they follow when "agent is not

probable," even though the monitoring response team indicated that it looked like this was not a false alarm.

Operators in the DCD EOC stated that dispersion modeling was done at the time of the event. Modeling data collected by DSHW investigators was for models run in the early morning hours of May 9, 2000. The models ran by the DCD EOC for this event showed that any release of agent would travel at most eight to 10 feet from the Stack (see Attachment 9).

Calculations of the amount of agent released from the Stack during the event were performed by EG&G personnel (see Attachment 11). Additionally, CDC performed independent calculations and modeled the event to determine if there was a health threat to any workers or residents in the surrounding communities (see Attachment 14). It was determined that there was no health threat to any worker or the community.

Analysis of the perimeter DAAMS tubes showed that no agent was detected in any perimeter DAAMS station downwind of the Stack. Although the perimeter DAAMS tubes were not pulled immediately by operators, a review of the data by DSHW showed that the analysis was performed in accordance with operating procedures. This data, as well as modeling data, show that no agent from the Stack release migrated off-post.

DSHW investigators met with EG&G personnel at the facility clinic. Discussions with them as well as a review of clinic records showed that no one sought medical treatment for possible agent exposure prior to or after the agent release.

Notification to the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste was made in accordance with the TOCDF Part B Permit.

According to Section 2.0 of the State of Utah CSEPP Appendices to the State Emergency Operations Plan (see Attachment 12), during a Limited Area Emergency, the DCD EOC provides notification to Tooele County and Utah County. At this time, Tooele County may go to a level of increased readiness but no immediate notification to the State of Utah, Division of Comprehensive Emergency Management is required. Decisions were made by two individuals that delayed the notification of local emergency management personnel.

CONCERNS

The following are items of concern that the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste will be addressing with the facility.

Jamming of the DFS feed chutes and the lower feed gate has been a recurring problem at TOCDF. The procedure for clearing jams in the chutes regularly causes difficulties for incinerator operators.

The entry to clear the chute jam was delayed because of approaching shift change and the fact that preparations for the entry could not be completed and the entry made before the shift change happened.

Operators need more opportunities for training besides real time on-the-job experience as well as better supervision in the control room.

The DAAMS tubes monitoring the perimeter of facilities located at DCD were not pulled and analyzed immediately upon confirmation by the DAAMS tubes in the DFS duct and Stack of the release. Additionally, for Station 905 that did show something on the "A" tube, the "B" tube was not analyzed.

When an ECR is monitored at the MPL level, operators may be getting a false sense of security. When the reading is below one MPL, the readout on the screen in the control room is green instead of red. This may cause some operators to underestimate the magnitude of the agent concentration.

Personnel who cleared the chute jam went on to perform ECR maintenance and placed waste on the DFS feed gate even though the incinerator was not operating normally and the waste could not be fed.

Stack temperature instrument TIT-9913 and pressure instrument PIT-9913 do not report to PDARS as stand alone instruments but instead report to FIT-9913 which then calculates the standard exhaust flow in the stack.

TOCDF personnel failed to correctly follow the contingency procedure in the permit for "Agent Detected in the Stack."